

HERBERT et al.
Appl. No. 09/807,515
February 2, 2004

AMENDMENTS TO THE CLAIMS:

Please amend claims 1-4, 12 and 13 as follows.

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. *(Currently Amended)* An impact ionisation avalanche transit time (IMPATT) diode device comprising:

- a ~~main~~avalanche region;
- a drift region; and
- a narrow bandgap region with a bandgap narrower than the bandgap in the ~~main~~avalanche region which narrow bandgap region (4, 40) is located adjacent to the ~~main~~avalanche region in order to generate within the narrow bandgap region a tunnel current which is injected into the ~~main~~avalanche region.

2. *(Currently Amended)* An IMPATT diode according to claim 1 wherein the narrow bandgap region is arranged to generate a tunnel current for injection into the ~~main~~avalanche region at the peak reverse bias voltage applied to the diode.

3. *(Currently Amended)* An IMPATT diode according to claim 1 wherein the narrow bandgap region is located at the edge of the ~~main~~avalanche region.

HERBERT et al.
Appl. No. 09/807,515
February 2, 2004

4. *(Currently Amended)* An IMPATT diode according to claim 1, wherein the narrow bandgap region is located between a heavily doped contact region and the ~~main~~-avalanche region.

5. *(Previously Presented)* An IMPATT diode according to claim 1, wherein the narrow bandgap region comprises one layer of narrow bandgap material.

6. *(Previously Presented)* An IMPATT diode according to claim 1, wherein the narrow bandgap region comprises a plurality of layers of narrow bandgap material.

7. *(Previously Presented)* An IMPATT diode according to claim 1, wherein the diode has a lo-hi-lo doping profile.

8. *(Previously Presented)* An IMPATT diode according to claim 7 wherein the diode is a Misawa p-i-n diode.

9. *(Previously Presented)* An IMPATT diode according to claim 1, wherein the diode is a double drift diode.

10. *(Previously Presented)* An IMPATT diode according to claim 1, wherein the diode is made of III-V semiconductor materials.

HERBERT et al.
Appl. No. 09/807,515
February 2, 2004

11. *(Previously Presented)* An IMPATT diode according to claim 1, wherein the diode is made of group IV semiconductor materials.

12. *(Currently Amended)* An IMPATT diode according to claim 11 wherein the narrow bandgap region is made of at least one layer of Silicon Germanium and the ~~main~~-avalanche region is made of Silicon.

13. *(Currently Amended)* An IMPATT diode according to claim 10 wherein the narrow bandgap region is made of at least one layer of Gallium Arsenide and the ~~main~~-avalanche region is made of Aluminium Gallium Arsenide.

14. *(Previously Presented)* An IMPATT diode according to claim 1, wherein the length of the drift region or regions is between 2 and 6 times the length of the avalanche region.

15. *(Previously Presented)* An IMPATT diode according to claim 14 wherein the length of the drift region or regions is between 3.5 and 4.5 times the length of the avalanche region.

HERBERT et al.
Appl. No. 09/807,515
February 2, 2004

16. *(Previously Presented)* An IMPATT diode according to claim 1, arranged such that at least part of the tunnel current can be generated by optical excitation.

17. *(Previously Presented)* A method of operating the IMPATT diode of claim 1, wherein an oscillating voltage across the diode has a period of between 4 and 12 times the transit time of the avalanche region.

18. *(Previously Presented)* A method according to claim 17 wherein the oscillating voltage has a period of between 7.5 and 8.5 times the transit time of the avalanche region.

19. *(Previously Presented)* A method according to claim 17 including the step of optically exciting at least part of the tunnel current.